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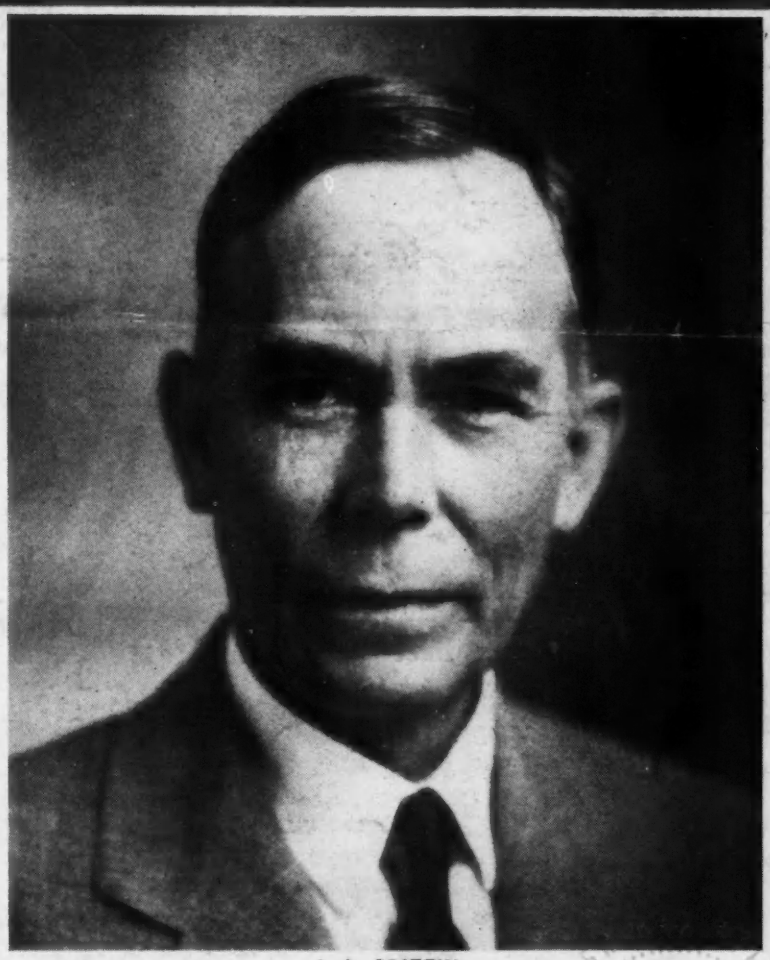

J. A. GRIFFIN

President Exchange National Bank, Tampa, Exchange National Bank, Winter Haven, Citrus Grove Owner, Recently Named Tampa's No. 1 Citizen, 1947

Vol. 29, No. 3 March, 1948

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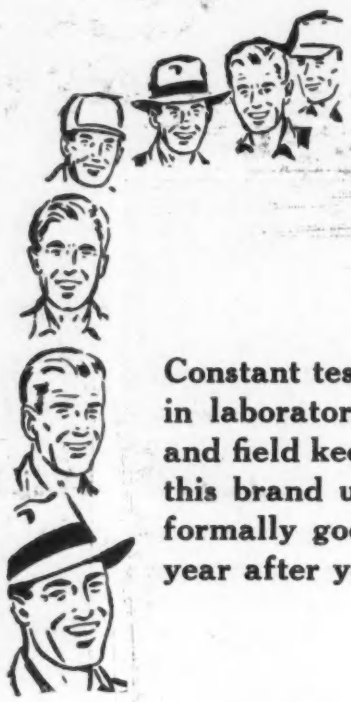

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New Insecticides And Their Application On Citrus...

W. L. THOMPSON
and
J. T. GRIFFITHS
At Meeting of Florida State Horticultural Society.

During the past four years a number of organic compounds have been developed for use as insecticides. Some of these are already in use and others are still in the experimental stage. When a new insecticide is to be tested, there are a number of factors to be considered and two or three years of experimental work is frequently required before the material can be recommended for general use. Some of the important questions to be answered are:

1. Toxicity of material to various species of insects and mites?
2. Toxicity, if any, to the tree?
3. Minimum concentrations which will give results?
4. Compatability with other materials in combination sprays?
5. Effect on beneficial insect population?

Until the research workers have had time to obtain at least preliminary answers to the above questions, it is not advisable to treat large acreages with any new insecticide.

Some of the new insecticides may have a limited but definite use in combating insects infesting citrus groves. Until recently there was no insecticidal spray or dust that could be used economically for the control of grasshoppers, plant bugs, ants and shot-hole borers. Now there are several materials which may be used effectively for the control of those insects. Fortunately, the above mentioned insects are not of major importance over a wide area, but any one of the above named group can be of major importance in one or more groves during certain years, and it is at least gratifying to know that there are materials which can be recommended for their control. One or two of the newer compounds may eventually replace some of the insecticides now in use, but only extensive experimental work plus commercial trials can determine their real value.

At the present time the Citrus Experiment Station is working with a number of the newer insecticides but it will take time before proper recommendations can be made for each of them. In this paper the materials and the results obtained with them are discussed very briefly because a full discussion of any one of them would require the full period.

O,O-diethyl-O-p-nitrophenyl thiophosphate commonly called Thiophos

(Continued on page 10)

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2-Amino-Pyridine, A Promising Inhibitor Of Decay In Oranges[1/]

by J. R. Winston

Introduction

Antiseptics have long been used for checking decay in citrus fruits. For this purpose they must possess high fungicidal properties, and at the same time be non-injurious to the commodity or to those who consume it over a long period. A number of chemicals that will give the desired degree of decay control are so toxic to animals that their use on foodstuffs is not permissable. Yet it is reasonable to assume that if the search is carried on long enough, someone will find an excellent decay inhibitor that meets all requirements of the health authorities.

With this objective in view, the U. S. Department of Agriculture Subtropical Fruit Field Station at Orlando, Florida, continued throughout the season of 1946-47 a search for an outstandingly effective but safe material for treating citrus fruits to prevent the development of decay at any time during the marketing period. In the 1946-47 season several hundred compounds of established fungicidal or fungistatic properties, including a number of pyridine derivatives, were used in screening tests on oranges to determine their decay-inhibiting qualities. From this number several were outstanding for rot control, but the 2-aminopyridine, hereinafter referred to as "2-AMP" for brevity, gave the most promising results.

Inasmuch as pyridine is a natural constituent of bone oil, there appeared some basis for suspecting that use of 2-AMP 2/ might meet the requirement of being non-toxic. Concurrently with the execution of the tests reported herein, other agencies have initiated feeding experiments to ascertain whether the material could be applied to oranges without detriment to the consumers of treated fruit. These tests have not been completed, nor have the findings to date been released. Pending a determination of the toxicity of this material its use on fruit is not sanctioned. However, enough fruit-treating experiments have been executed to justify the release of a progress report on this phase of the study.

The first dipping tests made with this material at the Orlando laboratory were set up in early November 1946. During the season more than 245 experimental lots totaling more than 13,000 fruits were used to evaluate 2-AMP as an inhibitor of decay in Florida oranges.

Experimental Procedure

These studies were confined almost exclusively to oranges that were ripe enough for market at the time of the testing under discussion. Such varieties as Parson Brown, Hamlin, Seedling, and Valencia, produced on mature trees, were used in their respective ripening seasons.

Upon delivery of the oranges to the laboratory from the groves, all lots of fruit were washed. While still wet they were transferred to a room maintained at 85°F. and 90 per cent relative humidity. Here they were subjected to ethylene gas for 48 to 60 hours to accelerate the development of stem-end rot; however, the gassing treatment renders fruit less liable to green mold rot.

The fruit was treated within a few hours after the gassing period. Some lots were immersed for a fixed period of 10 seconds in varying con-

1/ By J. R. Winston, senior horticulturist, G. A. Meckstroth, associate pathologist, and G. Lee Roberts, scientific aide, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

2/ The use of this material was suggested by the American Cyanamid Company, which supplied samples for screening tests.

centrations of 2-AMP in water, or in wax emulsion diluted to proportions commonly applied to citrus. In other experiments with a constant concentration of the antiseptic, the temperature of the bath was varied from 80° to 125°F., and in still other tests the length of the exposure to the bath ranged from 10 seconds to 3 minutes. None of the treated lots were rinsed subsequently to remove the adhering chemical. The dipped fruit was placed in trays to dry in open air, then transferred to a holding room.

Some inoculation experiments with green mold, Penicillium digitatum, were conducted on oranges harvested and inoculated the same day. The fruit was washed, pricked with ten needles to depths of about 1 mm., and dipped in a rich suspension of fresh spores taken from rotting oranges. The inoculated lots were held in a near saturated atmosphere at 70° F. for varying lengths of time before treatment with the antiseptic in wax emulsion. After application of 2-AMP, the fruit was surface dried in moving air and promptly placed in crates lined with paraffin paper, to assure the maintenance of an environment of high humidity, and promptly placed in the holding room, which was continuously maintained at about 80 percent relative humidity and 70°, a temperature favorable to the development of the principal rots of Florida citrus fruits. The uninoculated lots were inspected weekly over a period of three weeks, long enough to cover most marketing operations, while the inoculated oranges were inspected at intervals of three days over a nine-day period.

Results

2-AMP in water or wax emulsion: The preliminary tests with 2-AMP, ranging in concentration from 10 to 2½ percent, in water as well as in a wax emulsion commonly used on fruit as a fruit dip, were repeated several times with early and midseason oranges.

Inasmuch as all lots were subjected to ethylene gas, a treatment which is followed by less green mold than is ordinarily found in nongassed fruit, this rot developed in too small amounts even in the nontreated check lots to permit of safe interpretation. Therefore, only the data on stem-end rot (Phomopsis citri or Diplodia natalensis) will be considered in the initial tests.

Results reported in Table 1 show a remarkable control of stem-end rot by 2-AMP. In a water medium 10 percent 2-AMP gave the greatest control while 2½ percent gave the least, and the difference in decay suppression between the 10 percent and 5 percent solutions was not great. With fruit dipped in wax emulsion containing 2-AMP, the 2½ percent solution was almost as effective as the 10 percent.

With these feeler tests on midseason oranges as a background, experiments were conducted with Valencia oranges immersed for 10 seconds in 5 and 10 percent 2-AMP in water. Similar concentrations of the chemical were incorporated in the water phase of the wax emulsion, as another practical method of application for commercial operations. Table 2 gives the results from six groups of 11 test lots each.

Table 1. Total stem-end rot in gassed early and midseason oranges dipped in several concentrations of 2-amino-pyridine. Held 3 weeks at 70°F.

Treatment	No. Tests	No. Fruit	Stem-end Rot
			Percent
Check - water	3	75	57.3
10% 2-amino-pyridine in water	3	75	1.3
Check - water	9	242	65.3
5% 2-amino-pyridine in water	9	241	4.1
2½% do	9	244	9.4
Check - emulsion	4	100	47.0
10% 2-amino-pyridine in water	4	100	4.0
5% do	4	100	3.0
2½% do	4	100	5.0

In the series treated with 2-AMP in water, the miscellaneous decay, mostly side rot, was not of sufficient magnitude to be consequential. The greatest amount of green mold, 3.1 percent, was found in the untreated check, and the least, 1.3 percent, in the fruit treated with 10 percent 2-AMP. However, stem-end rot increased in the water-dipped checks from 6.9 percent in 7 days to 58.8 percent a week later, and to 70.2 percent after another week. The fruit dipped in 5 percent 2-AMP in water had 2.4 percent, 2.5 percent, and 3.8 percent stem-end rot, at the end of the first, second and third weeks respectively, whereas 10 percent solution of 2-AMP gave 1.3, 2.0 and 2.5 percent. Decay from all causes finally consumed 73.8 percent of the untreated fruit, and 5.8 and 4.2 percent in the lots receiving the weaker and stronger concentrations of 2-AMP respectively. When similar proportions of 2-AMP were added to the emulsion, the resultant decay control was of very nearly the same magnitude as with the water solution.

A consideration not evaluated in the table above is chemical injury to the rind of treated fruit. A trace of brown, slightly sunken spots, probably chemical injury, was observed in three of the eleven lots, following the application of 5 percent 2-AMP in water. The blemish increased measurably but probably not importantly, commercially speaking, during the holding period. No rind injury was observed on fruit receiving emulsion containing 5 percent 2-AMP. However, the 10 percent solutions in emulsions as well as in water caused an appreciable amount of rind injury which increased in number of affected fruits with the extension of the holding period, and which doubtless was present in sufficient proportions to be commercially significant. Rind injury developed more on the fruit treated with water solutions than on that treated with an emulsion containing the antiseptic.

2-AMP in water dip for 10 seconds, 1 minute, 3 minutes:

In another series of experiments with gassed oranges, table 3, a 5 percent water solution of 2-AMP was applied to the fruits for 10 seconds, 1 minute, and 3 minutes, respectively, at a uniform concentration of of 5 percent. In none of the lots did the miscellaneous wastage, mostly side rots, amount to as much as 2 0 percent, even after 3 weeks' holding. Likewise, green mold increased to only 2.4 percent in the check fruit, and to not more than 1.6 percent in the treated lots. In the case of stem-end rot, decay control was very effective with no significant differences due to the duration of the dip.

Not more than a trace of rind injury was detected in a few of the dipped fruits, and it was not in sufficient amount in any test to be of commercial significance; in fact, the injury may have been due to some factor other than the antiseptic.

2-AMP at 80°, 100°, 125° F.: Still another series of experiments was run to determine whether the fungicidal properties of 2-AMP could be increased by raising the temperature of the treating bath from 80° to 125° F. The time of exposure was 2 minutes in all cases. Two water

check temperatures, 80° and 125°, were selected since they represented the extreme limits at which the antiseptic was applied. Table 4 gives the different categories of decay cumulatively.

Again the miscellaneous decay, mostly side rot, was of no consequence since the maximum amounted to only 2.2 percent after a 21-day holding period; likewise green mold, which developed to some extent in all treatments, was of minor importance since the maximum after 3-weeks' holding was only 2.5 percent.

In the 80° F. water checks there was slightly more stem-end rot at the first, second, and third inspections, respectively, than at the corresponding inspection of the 125° check.

In the case of the fruit treated with 5 percent solution of 2-AMP, a progressive but slight decrease in stem-end rot was observed at each of the weekly inspections as the temperature of the bath was raised from 80° to 100°, and then to 125° F., the last temperature being that at which the usual commercial color-added or dye treatment is applied.

Various other tests with 2-AMP: Supplementary tests were set up to determine whether: (1) aqueous solutions of 2-AMP would deteriorate rapidly on standing; (2) it would mix with solutions used for the color-added treatment; (3) it would be compatible with the wax emulsions in common use; (4) a spreading agent would increase its efficacy; and (5) wrapping tissue, treated with this material would check decay.

Re-use of 2-AMP: Results from three tests indicate that an old (used) water solution of 5 percent 2-AMP was about as effective after one and two weeks' standing as when freshly prepared. The non-treated lots had 64.5 percent total decay; those treated with fresh solution developed 5.6 percent; and those treated with a 2-weeks-old solution, 6.5 percent in three weeks.

2-AMP in dye: The antiseptic apparently was not impaired when mixed with the "color-added" dye solution, nor was there any apparent change in the coloring properties of the dye, as indicated in two tests in which no decay developed in treated lots while 42 percent decay was noted in the check lots.

2-AMP with wax emulsion: The antiseptic mixed well with seven lots of wax emulsion used on fruit and retained usual decay-repressing properties.

2-AMP with spreading agent: Evidence obtained from four tests indicated that decay-inhibiting properties of 2-AMP were not increased by the addition of 0.1 percent of Vatsol O. T. The average of four tests gave 58.5 percent total decay in three weeks in untreated check lots, 7.8 percent in the lots treated with 5 percent 2-AMP n emulsion, and 9.0 percent where the spreader was added.

2-AMP in wrapping tissue: Plain wrapping tissue impregnated with a 10 percent solution of 2-AMP in isopropyl alcohol was moderately effective in checking decay in three lots of dead-ripe Seedling oranges in March as is shown by the average of three tests. After three weeks' holding the fruit in untreated wraps had developed 44.8 percent stem-end rot and 27.6 percent green mold, while that in treated wraps showed 9.8 percent stem-end rot and 5.8 percent green mold. Decay from all

(Continued on page 16)

Table 2. Decay in gassed oranges treated with 2-amino-pyridine (10-second dip, no subsequent rinsing).
Orlando, Florida — Spring, 1947

Treatment	No. Tests	No. Fruit	1 week at 70°F.				2 weeks at 70°F.				3 weeks at 70°F.			
			SER*	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay
			Percent				Percent				Percent			
Check in water	11	550	6.9	0.4	0	7.3	53.8	2.7	0.4	56.9	70.2	3.1	0.5	73.8
5% 2-AMP in water	11	550	2.4	0	0 1	2.5	2.5	0.7	0.4	3.6	3.8	1.6	0.4	5.8
10% 2-AMP in water	11	550	1.3	0	0.1	1.4	2.0	0 4	0.3	2.7	2.5	1.3	0.4	4.2
In wax emulsion check	11	550	8.0	0.2	0.2	8.4	56.4	0.9	0.3	57.6	73.8	2.0	0.6	76.4
5% 2-AMP in wax emulsion	11	549	1 3	0.2	0.1	1.6	2.0	1.1	0.5	3.6	2.5	2.7	1.2	6.4
10% 2-AMP in wax emulsion	11	550	0.2	0	0.2	0.4	0.7	1.1	0 2	2.0	0.9	2.6	0.7	4.2

* SER — Stem-end rot (**Diplodia natalensis** or **Phomopsis citri**).
Pen. — Green mold (**Penicillium digitatum**).
Misc. — Miscellaneous rots other than SER or Pen.

Table 3. Decay control in gassed oranges treated with 5 per cent 2-amino-pyridine in water for varying lengths of time.

Treatment	No. Tests	No. Fruit	1 week at 70°F.				2 weeks at 70°F.				3 weeks at 70°F.			
			SER*	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay
			Percent				Percent				Percent			
Water check 10 seconds	11	548	4.9	0	0	4.9	47.4	1.6	0.3	49.3	67.7	2.4	0.2	70.3
2-amino-pyridine 10 seconds	11	548	1.8	0	0.2	2.0	2.6	0.5	0.9	4.0	4.0	1.6	1.7	7.3
2-amino-pyridine 1 minute	11	549	1.6	0	0.6	2.2	1.8	0.9	0 8	3.5	4.6	1.5	1.0	7.1
2-amino-pyridine 3 minutes	11	550	1.8	0	0	1.8	2.9	0.4	0.7	4.0	4.7	1.6	1.7	8.0

* SER — Stem-end rot (**Diplodia natalensis** or **Phomopsis citri**.)
Pen. — Green mold (**Penicillium digitatum**).
Misc. — Miscellaneous rots other than SER or Pen.

Effects Of Length Of Growing Season And Oil Spray Timing On Scale Control . . .[1]

J. T. GRIFFITHS
Florida Citrus Experiment Station

With emphasis being placed on economy in the production of citrus fruit, it is essential that a grower consider some of the possibilities for getting maximum efficiency from any given grove operation. The following account is concerned with a better timing for oil sprays for scale control and consideration of the length of growing season as a factor in the ultimate scale control obtained.

During the past several years, spray and dust applications have been recommended for use as preventive rather than as curative measures. Thus, emphasis has been placed on maintaining low insect populations throughout the entire year. By so doing it was believed that brighter fruit and better tree vigor could be maintained. The efficacy of oil sprays as a means of controlling scale and thereby increasing production has been ably demonstrated by Thompson (1947) when he showed an increase of one box per tree per year for twelve years on pineapple oranges where he compared oil sprayed plots against trees receiving the same nutritional sprays but where no oil was applied. This fact clearly demonstrates the advisability of an annual oil spray for most groves. If at all possible, scale control should be so planned that one annual spray is sufficient for control, and this spray should be so timed that it will yield a minimum of scale for the twelve months period following. Thompson (1942) stated that summer oil sprays had resulted in more satisfactory scale control than those applied during any other season. The early summer months were recommended specifically so that sprays would be applied before scale populations became heavy at which time they caused damage and were also more difficult to control. Tables I and II below show the results of oil sprays applied by two different cooperative associations located in Polk County. They include data for groves sprayed in 1945 and 1946. Spray dates are divided into five groups. January—May and September—October are lumped together because too few groves were sprayed in any one month to yield a reliable figure. The percentage of groves in which purple scale control was unsatisfactory is shown for both associations. Red scale was of minor importance in both operations and the percentage of groves with some red scale is noted for only Association A. Unsatisfactory control of purple scale was recorded where any of three conditions existed: necessity for a second oil spray, heavy scale infestations in January, or the need for a copper oil spray to reduce scale the following spring. In addition to these figures the percent of the groves receiving arsenic on grapefruit is also included. No attempt to differentiate between the amount of oranges or grapefruit was made and the method of application of arsenic was not recorded, but it was usually applied in the oil spray. Of course, it was applied only to grapefruit and the figure for percent arsenated groves merely means that some of the grapefruit in the grove received arsenic.

When unsatisfactory purple scale control is considered, certain features are obvious. In the three instances where oil sprays were applied prior to June 1, from 51 to 93 percent were recorded as unsatisfactory. Thus, the obvious conclusion would be drawn that sprays prior to June 1 usually do not result in satisfactory purple scale control. In three of the four years, the lowest percentage of failures was recorded in July. These two facts, based on field results, are in agreement with Thompson's (1942) state-

Table I. Results of Oil Sprays for Association A.

Date Sprayed	1945 Season			1946 Season		
	No. Groves Sprayed	% Purple Scale Failures	% with Red Scale	No. Groves Sprayed	% Purple Scale Failures	% with Red Scale
Jan.-May	0	....	....	8	51	63
June	23	39	26	41	29	39
July	43	25	12	64	5	38
Aug.	70	22	3	36	11	25
Sept.	10	10	0	0	....	....
% Arsenated	21	19	69	40	48	64

Table II. Results of Oil Sprays for Association B.

Date Sprayed	1945 Season		1946 Season	
	No. Groves Sprayed	% Purple Scale Failures	No. Groves Sprayed	% Purple Scale Failures
Jan.-May	14	93	16	88
June	21	62	10	60
July	9	11	29	21
Aug.	6	17	16	25
Sept.-Dec.	6	17	....	....
% Arsenated	13	26	15	24

1/ Paper presented at Camp McQuarrie meeting in August 1947.

ment that June and July sprays were preferred for maximum scale control benefits. The fact that oil sprays in August or later yielded generally good results can be misleading since in many instances too much scale had already developed and the oil spray was then a curative rather than a preventive measure. Under these circumstances the scale had already hurt the tree and possibly the yield. Excessive scale is always harder to control, and as the figures demonstrate, oil sprays later than August 1 were not as successful as those applied in July. In addition, where excessive scale has been present, oil sprays often hasten the formation of dead wood in the trees. Although the wood would have died ultimately, the oil spray intensified the situation.

Reference to Table 1 shows that as far as Florida red scale is concerned, the later the spray date, the fewer the groves with red scale. It will also be noted that in Association A, red scale was far more prevalent in 1946 than in 1945. In general spray dates were earlier in 1946 and the warm fall temperatures discussed below added more time to the season during which the scale could readily reproduce. Arsenical sprays appeared to be related to red scale increases. In 1946 and 1947 where only 21 and 40 percent respectively of the groves received arsenic, 69 and 64 percent of those groves with red scale received arsenic. Approximately the average percentage of arsenated groves was encountered where purple scale were prevalent. Thus, it appears that arsenic sprays may be related to red scale increases. This factor is being studied further. At present, it can only be stated with certainty that red scales were associated with either arsenic, grapefruit, or early spray dates. These factors cannot be isolated in this study.

In general, it appears that scale control was not as satisfactory in 1946 as in 1945. This fact is probably primarily concerned with the duration of warm weather. Both Florida red scale and purple scale can grow and reproduce during most of the year. However, during the period from November to May, they probably reproduce slowly and population increases would be expected to be at a minimum. Optimum conditions for scale development are attained during June, July, August, and September. Either an early spring or a late fall could materially lengthen the period which was satisfactory for normal growth and reproduction. Both of these situations occurred in 1946. The relationship between the duration of the period that scale can reproduce readily and the effectiveness of the scale control program is probably an important one. Thorne (1946) reported such a situation in the El Cajon area in California in 1945. There, high October temperatures apparently resulted in abnormal California red scale increases in the fall of the year. A similar situation was undoubtedly responsible for the excessive scale infestations experienced in Florida in the fall of 1946. The purple scale which had built up in 1946 survived the February freeze in 1947 and in spite of a very late spring, many groves started the summer with heavy purple scale infestations. October and November 1947 have been warmer than average and as a consequence, Florida growers again entered the winter months with heavier than normal purple scale infestations. Florida red scale was markedly reduced by the freeze in February 1947 (see Griffiths, 1947). This, coupled with the late spring, resulted in approximately normal fall red scale infestations. Reference to the past five years temperatures have indicated a marked correlation between excessive scale infestations and fall and spring temperatures. It is believed that a study of these relationships may yield information which will make it possible to better plan a satisfactory scale control program in future years.

In view of the present knowledge certain facts should be considered by a grower when planning his scale control program. It now appears that optimum timing for oil sprays for scale control would be during the first two weeks in July. However, it is fully realized that where large acreages are involved, it will be necessary to start earlier and end later. Thompson and Sites (1945) reported that trees sprayed in August and September with oil sprays produced fruit with lowered soluble solids as compared with trees sprayed in June and July. Thompson (1942) stated that August and September sprays adversely affected degreening of the fruit. These two factors are amply sufficient to rule out August and September oil sprays except in very exceptional circumstances. Adequate planning should prevent such exceptions. Thompson (1947) showed that the dead wood produced in the freeze of February 1947 was influenced by the timing of single oil sprays with excessive amounts of dead wood being produced by October, November, and December sprays. As noted in Tables I and II, scale control has not been as satisfactory after August 1. Where no oil has been applied prior to August, infestations often become excessive. When infestations become too heavy, it is most difficult to control scale with a single oil spray. These facts yield the obvious conclusion that oil sprays after August 1 should be avoided. Reference again to Tables I and II shows that oils applied before June 1 did not give satisfactory scale control. In addition. as noted by Thompson (1942), oil sprays applied to oranges between about May 15 and June 15 may cause external injury to the fruit. Thus, from the standpoint both of maximum scale control and minimum effects on fruit quality, June and July remain as the optimum times for oil sprays. It may be noted that, in general, June and more particularly dates prior to June 15 are not as satisfactory as those in late June and July. Therefore, it is suggested that the six weeks between June 15 and July 31 offer the best time for oil spraying large acreages. If necessary, sprays may be applied earlier, but this should be avoided if possible. In view of coloring and solids difficulties, it is suggested that varieties be sprayed in the following oredr: early oranges; early (arsenated) grapefruit and mid-season oranges; Valencia oranges; and lastly, unarsenated grapefruit. However, where excessive scale infestations are present and only a single oil spray is desired, it should be delayed until the period between July 1 and July 15.

Summary and Conclusions

The effectiveness of oil sprays applied at different dates in 1945 and 1946 by two cooperative associations were studied. Sprays applied in July appeared to be most satisfactory for optimum purple and Florida red scale control. This fact was coupled with the adverse effects to fruit quality of either early or late oil sprays to conclude that, where possible, oil sprays should be applied between June

(Continued on page 22)

NEW INSECTICIDES AND THEIR APPLICATION ON CITRUS

(Continued from page 4)

3422 or just 3422 is one of the newer materials that shows promise for the control of a wide range of insects infesting citrus trees. This material should not be used generally until it has been tested thoroughly since, according to the manufacturer, 3422 is quite poisonous in the concentrated form and it remains to be seen how toxic it is to human beings in the dilute form. However, there are a number of insecticides now in general use which are poisonous in the concentrated form but not particularly harmful in dilute sprays or dusts and it is hoped that the same will be true of this material.

According to the manufacturer 3422 can not be used satisfactorily in strongly alkaline solutions which limits its use in some combination sprays and much remains to be done in determining the materials it is compatible with and the dilutions needed to kill the various insects to which it is most toxic. Results obtained to date indicate that the toxicity of 3422 to insects is immediate and that it does not seem to have much residual effect.

Preliminary experiments with 3422 indicate that it is effective in killing scale insects. Where one-half pound of the active ingredient per 100 gallons of water was used, purple scale populations were reduced on an average of 81 percent as compared to an increase of 15 percent in untreated plots. Florida red scales were reduced to an average of 70 percent as compared with an increase of 9 percent in the check. Citrus mealybugs. on oranges, were reduced 65 percent while they increased 27 percent in the check. Rust mite populations were reduced to a very low level, no mites being observed 20 days after an application of 3422 in two different groves while checks showed a 30 percent infestation. A citrus aphid infestation was reduced 99 percent with only a few living aphids being observed in tightly curled leaves.

Since 3422 kills scales and mites it becomes a potentially important insecticide to citrus growers. Extensive testing will be carried out during the next year to determine the advantages and disadvantages of this material.

Di (chlorophenoxy) methane, known as K 1875 is one of the newer organic compounds which looks very promising for the control of purple mites. In 1946 Jeppson (3), in California, reported that concentrations of one pound per 100 gallons of spray or 4 percent or more of the active ingredient in dusts gave satisfactory control in preliminary field tests. Results of preliminary field experiments at the Citrus Station indicate that 0.8 to 1.0 pound of the active ingredient per 100 gallons of spray was as effective as DN Dry Mix (40 percent dinitro-o-cyclohexyl phenol) at 2-3 pound per 100 gallons. Where thorough coverage was obtained no living purple mites were observed for at least 12 weeks after single applications of K-1875 at either 0.8 or 1.0 pound per 100 gallons. This material is one of the few newer organic compounds which is effective in alkaline solutions, consequently it was combined experimentally with a number of the combination sprays commonly used on citrus. It was found to be effective combined with the following: (1) Lime-sulfur; (2) lime-sulfur and wettable sulfur; (3) lime-sulfur, zinc sulfate and wettable sulfur; (4) zinc sulfate, hydrated lime and wettable sulfur; (5) zinc sulfate, borax, hydrated lime and wettable sulfur; and (6) zinc sulfate, neutral copper, hydrated lime and wettable sulfur.

Young citrus foliage appeared to be more tolerant to K-1875 than to DN but more tests will be necessary before definite conclusions can be drawn. Experimental work is being continued with this material in both sprays and dusts.

Diphenyl trichorethane or DDT. The use of DDT on citrus in Florida will probably be limited because of the toxic effect on beneficial insects. Griffiths and Thompson (3). 1947, reported increases of Florida red scales following 1 to 2 applications of DDT combined with either sulfur or an oil emulsion. It was concluded that the increase of red scales was a result of practically eliminating the Florida red scale parasite: **(Psudohomalapoda prima** (Gir) and **Prospaltella aurantii** How.) and the twice stabbed ladybeetle. Where DDT had been applied with an oil emulsion for two consecutive years there was an averge of 200 red scles per leaf as compared to 1 scale per leaf where the DDT had been omitted in the oil spray. No parasites were observed in scales where the DDT had been used while there were 35 parasitized scales to every 100 living scales where oil alone was used. Citrus mealybugs and purple mites also increased following DDT sprays.

Osburn (4), 1945, reported satisfactory control of the little fire ant **(Wasmannia auropunctata** (Roger) when he sprayed the trunks and main limbs with a DDT-fuel oil emulsion.

The use of DDT for the control of shot-hole borers in citrus was reported by Thompson (5), 1945, The entrance of the beetles into the trunks of the trees was checked by spraying the trunks with DDT at the concentration of one ounce of DDT in 1 gallon of water. Dead beetles were found at the base of treated trees when the last inspection was made two weeks after treatment.

Benzene hexachloride or BHC has been found to be effective in controlling grasshoppers, plantbugs, citrus aphids and to some extent ants, but it was not effective where applied for the control of purple mites.

BHC should not be used in sprays or dusts containing hydrated lime but it can be combined with pyrophylite, clays, talcs and sulfur. BHC has a heavy musty odor which may be detected in the grove several days after an application. At present it is not recommended that BHC be sprayed or dusted on trees from the time the fruit has set until September 1 since in some instances where trees were dusted or sprayed during the summer an "off-taste" was detected in some of the oranges when they ripened. The taste was more pronounced when oil had been combined with BHC in the spray. No bad flavor has been detected when BHC was appiled as a dust or spary after September 1st. It should never be combined with an oil emulsion if the spray is to be applied on citrus trees carrying fruit. The taste of BHC was very noticeable in oranges six months after an application of BHC-oil emulsion spray.

BHC contains several isomers but the gamma isomer has been found to be the most potent as an insecticide. Growers should become familiar with the term gamma isomer because the insecticidal potency of BHC is reported as the percentage of the gamma isomer in the material. For instance, a 50 percent wettable BHC material containing 10 percent gamma isomer is more potent than a 50 percent wettable material containing 6 percent of the gamma isomer.

(Continued Next Month)

Reviewing The Sour-Orange Scab Problem In Florida/

Seven or possibly eight diseases attack foliage and fruits of citrus in Florida and adjacant areas. Three of that number—sour-orange scab, melanose, and withertip of lime—are of sufficient importance to warrant regular control programs. Only sour- orange scab, **Sphaceloma fawcettii**, will be discussed here.

Scab was probably the first disease problem to trouble the citrus grower in Florida. This disease was noted in 1884 and formally reported in 1886 as "orange-leaf scab" by Prof. Lamson-Scribner. Fawcett (1), Winston (7) Peltier (4), and others studied the problem from the control standpoint. Later Anna E. Jenkins (3) conducted intensive research on the causal organism. She found that the fungus was not a **Cladosporium**, as formerly supposed, but a species of **Sphaceloma** which she named **Sphaceloma fawcettii** in honor of Dr. H. S. Fawcett who worked on the disease in Florida in the early days. Besides the sour-orange scab that attacks lemon, grapefruit and the mandarin oranges in Florida, the Gulf Coast, the West Indies, South America, the Orient and elsewhere, at least two distinct species are recognized: the species that attacks lemons, mandarins and occasionally sweet oranges (but not grapefruit) in Australia, and the species that attacks the fruits of sweet oranges (apparently immune to sour-orange scab) in South America.

Comparatively little new information has appeared since Ruehle's work on scab in 1939 (5) but that is no indication that the problem is no longer important. It is well to refresh our thinking particularly as to the habits of growth of the causal organism and their relationship to the problem of control. If these relationships are understood, one is better able to effectively and efficiently carry out control measures.

Let us see how the severity of scab disease is affected by environment. First of all, this fungus lives over from one season to the next on twigs and foliage, and the amount of infection carried over the winter frequently determines the severity of early infection the following season. Another important environmental factor is the relationship of temperature to growth of the fungus and to susceptibility of citrus tissues. Fawcett (1) found that scab spores were produced at temperatures between 56 degrees and 82 degrees F., with most abundant production occurring at 70 degrees F., and Peltier (4) found citrus plants susceptible to infection at temperatures between 59 degrees and 74.3 degrees F. Thus the infection range of approximately 16 degrees F. closely parallels the range of temperature for spore production. This fact largely explains why citrus does not become infected with scab in Manila, P. I., where the mean temperature rarely falls below 77 degrees F., and partially explains the frequently noted fact that scab at Ft. Myers, Fla., is more severe than at Miami. The mean minimum temperature for Miami passes the 75 degree F. mark in June and remains above it until the latter part of September, while at Ft.. Myers the minimum

/ By J. F. L. Childs, associate pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Orlando, Florida.

temperature remains within the temperature range for infection during the entire summer rainy period. The comparative dryness of the spring weather at Miami, over that at Ft. Myers, augments the effect of temperature. The relative susceptibility of the tissues to infection is a third factor. Only young immature tissues can be invaded by the fungus. It has been shown by Winston (7) that such tissues (leaf, stem, and fruit) become progressively more resistant to infection until virtual immunity is reached at maturity. Temperature may affect susceptibility through its effect on the rate of maturation. According to Peltier, grapefruit leaves mature rapidly at lower temperatures and more slowly at higher temperatures with consequent changes in the period of susceptibility.

A fourth but very important factor in scab infection is the presence of free moisture on the surface of susceptible tissues. Frequent summer rains provide ideal moisture conditions in Florida and were it not that the spring months are relatively dry, scab would be more serious. The length of the period during which free moisture remains on leaves, twigs and fruits is less important for scab than in the case of melanose (**Phomopsis citri**) because of the extreme rapidity with which scab spores germinate. In regions such as California and parts of Australia, rains during the growing season are rare and scab disease is no problem even though temperature conditions are favorable.

Species and horticultural varieties of citrus differ greatly in their susceptibility to sour-orange scab disease. In varieties propagated by seed, such as rootstocks, there is often slight variation in susceptibility so that individuals of a typically immune variety may occasionally show slight infection. The relative susceptibility of a number of citrus varieties shown in table 1 is the result of inoculation studies reported by Winston et al. in 1923 (7) and 1925 (8). From the table it is seen that with the exception of two lemon varieties of no commercial importance, all lemons are very susceptible. Lemons tend to bloom and set fruit continuously during the warmer months. As a consequence, the fruits are susceptible over a long period and require relatively frequently spraying for control of scab. Grapefruit varieties as a group are about one-half as susceptible as lemons, although the Royal and Triumph varieties, probably sweet-orange hybrids, are exceptions in being highly resistant. For all practical purposes the sweet oranges are immune to sour scab and therein lies one of the secrets of their success under Florida conditions.

Attention should be called to the nurseryman because scab has such a marked stunting effect upon young plants that a program of protective sprays becomes a virtual necessity for rough lemon, sour orange, and Sampson tangelo.

Now that we have a picture of the disease situation, what about control measures? To date, nothing has supplanted copper for the control of sour-orange scab. Of the many forms of copper, none has excelled Bordeaux mixture in effectiveness as well as in cheapness. Several other copper compounds may give as good control if used at concentrations of equal or greater metallic copper content, though as a class their poorer adhesive properties render them somewhat less effective under severe conditions. Correct timing and frequency of

Table 1. Relative susceptibility of citrus species and varieties to **Sphaceloma fawcetti**, (7, 8).

Name	Range of susceptibility a/ 0	1	2	3	4
Poncimes trifoliata	—	—	X	—	—
Kumquat, Nagami	—	X	—	—	—
Kumquat, Marumi	X	—	—	—	—
Citron, Corsican	X	—	—	—	—
Lemon, Dwarf Chinese	—	—	—	X	—
Lemon, Kennedy	—	—	—	—	X
Lemon, Lamb	—	—	—	—	X
Lemon, Rough	—	—	—	—	X
Lemon, Sweet	—	—	—	X	—
Lemon, Willa Franca	—	—	—	—	X
Lime, Mexican	X	—	—	—	—
Lime, Persian	X	—	—	—	—
Lime, Rangpur	—	—	—	—	X
Grapefruit, Davis	—	—	—	X	—
Grapefruit, Duncan	—	—	—	X	—
Grapefruit, Foster	—	—	—	X	—
Grapefruit, Marsh	—	—	—	X	—
Grapefruit, Royal	X	—	—	—	—
Orange, Bittersweet	—	—	—	—	X
Orange, Sour	—	—	—	—	X
Orange, Jaffa	X	—	—	—	—
Orange, Parson Brown	X	—	—	—	—
Orange, Pineapple	—	X	—	—	—
Orange, Valencia	X	—	—	—	—
Orange, Washington Navel	—	X	—	—	—
Mandarin, King	—	—	—	—	X
Mandarin, Clementine	—	—	—	X	—
Mandarin, Cleopatra	X	—	—	—	—
Mandarin, Dancy	—	—	—	X	—
Mandarin, Satsuma	—	—	—	X	—
Temple orange	—	—	—	—	X
Tangelo, Sampson	—	—	—	—	X
Tangelo, Thornton	—	—	—	—	X
Citrange, Rusk	—	—	X	X	—

a/ 0, 1, 2, 3, and 4 signify respectively no infection observed, very rarely attacked, slightly susceptible, moderately susceptible, and very susceptible (decreasing in geometric order from right to left, so that group 3 is half as susceptible as group 4)

the relative susceptibilities of several of the more important rootstock varieties, namely rough lemon, sweet lemon, sour orange, Cleopatra mandarin, Sampson tangelo, and Rusk citrange. All are moderately to very susceptible with the exception of Cleopatra, which is immune. The susceptibility of rootstocks is an important point for

application are often more important than the small difference between the effectiveness of the three or four best copper materials.

At this point someone should remind us that copper sprays, and Bordeaux mixture in particular, often cause an increase in the population of scale insects. It is believed that this comes about in two ways; (a) that the spray deposit enables more of the scale insect in the crawler stage to cling to foliage and become established, and (b) that the fungicidal properties of copper sprays kill the friendly fungi that would otherwise parasitize and kill scale insects. According to the results of experiments on purple scale, by Holloway and Young (2), a great increase in scale population results from spray materials that produce a heavy deposit, but no significant difference in population occurs due to the presence or absence of copper in the spray deposit (table 2). Furthermore, they showed (table 3) that the natural mortality of scales decreased in the presence of a heavy spray deposit but again the presence or absence of copper was not a factor. In short, any spray that leaves a granular residue on the foliage may cause the scale population to increase. Fungicidal properties of the deposit have nothing to do with the matter, and conversely from that, fungi are not a factor in the control of purple scale. Thus it seems that attempts to avoid a scale problem through

the use of copper sprays of poor adhesive and fungicidal properties is merely appeasement of the scale problem at the expense of disease control. Fungus control and scale control are two separate problems requiring different though not necessarily separate control measures.

It was shown in 1922 by Winston (6) and later by others that oil emulsion for scale control could be combined with Bordeaux mixture. The advantages of combined spray were immediately apparent and it was generally adopted. Concurrently with general use of the combination spray, cases of fruit blemish and even defoliation were reported and its use fell into disrepute where it remains to the present day. However, oils are being used with neutral copper sprays with entire satisfaction; and for the dormant spraying of scaly, scab-infected citrus groves copper-oil of proper formulation is clearly indicated. A fungicide that would deposit little or no granular residue and remain effective for thirty days would go far toward solving the copper-scale problem. Such a fungicide may be found among the organic compounds but at present none of these can be recommended as a satisfactory substitute for copper in sour-orange scab control.

For directions for control of sour-orange scab in Florida, growers should consult the Spray and Dust Schedule issued by the Florida Citrus Commission at Lakeland.

Table 2.—The purple scale population resulting from sprays having two levels of residue and two levels of copper applied the previous year (2)

Levels of residue	Total living and dead scales		
	Copper absent	Copper present	Total
	No.	No.	No.
Low	663	1,681	2,344
High	3,614	2,643	6,257
Total	4,227	4,324	

Significant difference at 1% level = 3,353

Table 3. Percent of total mortality of the purple scale after the use of sprays with two levels of inert residue and two levels of copper (2)

Levels of residue	Total mortality		
	Copper absent	Copper present	Total
	Percent	Percent	Percent
Low	83	75	79
High	58	57	58
Average	71	66	

Significant difference at 1 percent level = 11.0

Literature Cited

(1) Fawcett, H. S., Jour. Ag. Res. 21:243-253, 1921.

(2) Holloway, J. K., and Young, T. R., Jour. Econ. Ent. 36:453-457, 1943.

(3) Jenkins, A. E., Phytopath. 15:99-104, 1925.

(4) Peltier, G. L., and Frederich, W. J., Ag. Res. 28:241-254, 1924.

(5) Ruehle, G. D., and Thompson, W. L., Fla. Ag. Exp. Sta. Bull. 337, 1939.

(6) Winston, J. R. U.S.D.A. Circ. 215, 1922.

(7)———, U.S.D.A, Bull. 1118, 1923.

(8)———, Bowman, J. J., and Bach, W. J., Jour. Ag. Res. 30:1087-1093, 1925.

The present is always pregnant with the future.

Permit Requirements For Citrus Fruits Resumed

Now that Mexican fruitflies from northeastern Mexico have begun to invade citrus plantings in adjoining Texas counties, it has become necessary, effective February 9, to restore permit requirements under the quarantine on account of this insect, according to an announcement by Dr. P. N. Annand, chief of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

Following disappearance of adult fruitflies last fall, the permit requirements were temporarily suspended effective September 1. Northward migration of the flies across the border reintroduces the possibilty of spreading the pest in maturing citrus fruits. For this reason it is necessary to resume federal supervision of citrus fruits moving from regulated sections.

Affected by this restoration are the Texas counties of Brooks, Cameron, Dimmit, Hidalgo, La Salle, Webb, and Willacy, as well as part of Jim Wells county.

Production of almonds, filberts, pecans and walnuts in the United States increased from 23 million pounds in 1909 to 348 million pounds in 1945.

Florida Citrus Mutual Wins Strong Support

By The Editor

The Florida Citrus Mutual, outgrowth of a suggestion first made by Latt Maxcy, citrus grower, shipper and canner, member of the Florida Citrus Commission and an outstanding figure in the Florida citrus industry, is gaining support from every phase of the industry.

Numerous co-operative organizations, including the big Florida Citrus Exchange and the Waverly Growers Co-Operative, have endorsed the new organization, the purpose of which is to control shipments and establish minimum prices for the sale of citrus fruits. Many canners, among them the J. William Horsey Corporation, have not only given their endorsement to the organization, but are strongly urging others to do likewise. Among growers the attitude is strongly favorable and the campaign to enlist grower membership is going actively forward.

The relations existing between the Florida Citrus Mutual and the United Citrus Growers of Florida, a strictly grower organization, have so far been of the most amicable character and the two organizations appear to be working in perfect harmony.

While it has not been possible to put the objectives of the organization into operation in time to apply to the marketing of the Valencia crop this season, the outlook at this writing is that the plans will be sufficiently perfected to enter the next shipping season with a sufficient percentage of growers signed up to make the Mutual a success.

At no time in the history of the industry in Florida has there been as nearly unanimous sentiment toward any suggested project for bringing all phases of the industry into one organization for control of marketing and stimulation of prices.

Latt Maxcy, head of Florida Citrus Mutual, is backed by leaders of the industry in official positions and with a board of directors composed of men who have long been recognized among the most active in bringing about unified effort in the industry. With the organization in such capable hands, and with all elements of the industry apparently working harmoniously toward a common end, it is not too much to hope that the Florida Citrus Mutual may achieve beneficial results toward which others have striven and failed. Certainly no other organization has entered the field with such apparently hopeful signs for success.

2-AMINO-PYRIDINE, A PROMISING INHIBITOR OF DECAY IN ORANGES 1/

(Continued from page 7)

causes amounted to 73.7 percent in the check lots and 18.6 in the treated fruit. It is interesting to note that considerable rind injury characterized by scattered brown, slightly sunken spots developed slowly in each of the lots wrapped in treated tissues. This blemish was not noticeable until after the first week.

Somewhat later, during the Valencia season, plain wrapping tissue was treated with 5 percent and 10 percent 2-AMP in wax emulsion. After drying, these wraps were used with three lots of fruit.

After 21 days 73.3 percent decay from all causes had developed in the check fruit. Of this 72.0 percent was stem-end rot and and 1.3 percent green mold. In the same length of time 10.7 percent stem-end rot, 2.0 per cent green mold, and 0.6 percent decay from all other causes appeared in the fruit wrapped with tissue dipped in wax emulsion containing 5 percent 2-AMP.

The control of decay in fruit covered with tissue impregnated with 10 percent 2-AMP in wax emulsion was no greater than with that in the wraps with the weaker dosage, to wit, there was 14 percent rot from all causes, of which 13.3 percent was stem-end rot and 0.7 percent green mold.

Inoculation experiments with 2-AMP and with sodium ortho-phenyl-phenate: Inoculation experiments were initiated in which freshly wounded oranges were inoculated with spores of the green mold fungus and later treated at intervals with a 5 and a 10 percent solution of 2-AMP in wax emulsion. In a similar series of experiments 1¼ percent sodium ortho-phenyl-phenate was added to the wax emulsion. The results of the tests, conducted under more extreme conditions than are likely to prevail in commercial practice, are given in table 5.

Under these extreme conditions fruit treated with 10 percent 2-AMP in wax emulsion within a few hours after inoculation held up well for nine days. A progressive decrease in decay repression was noted with the increase of the time interval between inoculation and antseptic treatment. When the concentration of 2-AMP was reduced to 5 percent its mold inhibiting properties were greatly weakened.

Under the same extreme conditions 1¼ percent sodium ortho-phenyl-phenate failed to give a lasting protection against green mold development, although it retarded spoilage more effectively than 5 percent 2-AMP. It is interesting to note that when the antiseptic was applied 8 hours after inoculation, the repression of decay was more effective than when the application was made at a greater or less interval after inoculation. In none of the separate tests was the decay development 9 days after inoculation greater in the lots receiving the antiseptic 8 hours after inoculation than in those treated 4 hours after. There seems to be no satisfactory explanation for this phenomenon, which occurred on 9 separate occasions.

Table 4. Decay in gassed oranges treated with 5 per cent 2-amino-pyridine solution in water (2 minute dip, no subsequent rinsing) Temperature of treatment variable

Treatment	No. Tests	No. Fruit	1 week at 70°F.				2 weeks at 70°F.				3 weeks at 70°F.			
			SER*	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay	SER	Pen.	Misc.	Total Decay
			Percent				Percent				Percent			
Water check 80°F.	11	558	6.3	0 4	0.1	6.8	48.7	1.4	0.4	50.5	71.3	1.8	0.6	73 7
Water check 125°F.	11	526	3.4	0.2	0	3.6	39.0	1.0	0.1	40.1	65.0	1.5	0.2	66.7
2-amino-pyridine 80°F.	11	555	1.6	0	0.4	2.0	2.7	0.2	0.7	3.6	3.4	0.9	2.2	6.5
2-amino-pyridine 100° F.	11	557	1.1	0.2	0.3	1.6	1.8	0.9	0.9	3.6	2.7	2.5	1.6	6.8
2-amino-pyridine 125° F.	11	556	0.5	0 4	0	0.9	0.7	0.7	0.2	1.6	1.4	1.4	0.8	3.6

* SER — Stem-end rot (**Diplodia natalensis** or **Phomopsis citri.**)
Pen. — Green mold (**Penicillium digitatum**).
Misc. — Miscellaneous rots other than SER or Pen.

Discussion

The need for some effective means of checking decay in Florida citrus fruit becomes obvious when it is seen that decay developed in approximately 50 percent of the untreated oranges in 2 weeks. While this rate is abnormal, it is sometimes encountered in commercial op-

Table 5. Development of green mold in inoculated oranges treated with wax emulsions containing 2-amino-pyridine and with sodium ortho-phenyl-phenate

Treatment	No. Tests	No. Fruit	Hours between inoculation and treatment	Days at 70° F.		
				3	6	9
				Percent infection		
Check emulsion	3	78	8	83,3	100.0	100.0
10% 2-amino-pyridine	3	79	4	0	1.3	2.5
do	3	78	8	1.3	2.6	6.4
do	3	79	16	3.8	8 9	10.1
do	3	79	24	15.2	34.2	40.5
Check emulsion	6	228	8	94.3	100.0	100.0
5% 2-amino-pyridine	6	228	4	7.0	24.6	37.3
do	6	228	8	7.5	18.4	27.6
do	6	229	16	27.9	52 4	56.8
do	6	227	24	52.9	70.9	75.3
Check emulsion	3	150	8	99.3	100.0	100.0
1¼% Dow A*	3	150	4	1.3	14.7	26.0
do	3	150	8	0	9 3	18.0
do	3	151	16	2.0	24.5	29.1
do	3	152	24	15.8	46.7	53.3

* Dow A — sodium ortho-phenyl-phenate.

erations, especially when the fruit is ripe.

Inasmuch as 2-AMP is a derivative of pyrdine, which in turn is found in considerable quantities in bone oil, there may be some basis for assuming that it may prove to be acceptable material for treating fruit for the prevention of decay.

For these tests no fruit drying facilities were available so all treated lots were placed in trays and set in the open air to dry. Sometimes the fruit dried rather quickly, but at other times, especially in cloudy or inclement weather, the drying time was several hours. Therefore, since injury is probably related to the length of time the fruit remained wet with the solution, it is probably unwise to place much emphasis on the rind injuries or to draw conclusions relative to the danger thereof in treatments given under commercial handling conditions.

The 2-AMP antiseptic mixes well with the general run of wax emulsions commonly applied to citrus fruits, as well as with water. Used solutions retained their effectiveness after standing for at least 2 weeks. An effective application can be made by passing the fruit through a small tank containng 5 percent solution 2-AMP in wax emulson or in water, or probably by flooding the solution on fruit for a few seconds in order to assure a thorough coverage. The material also is compatible with the dye used in the color-add treatment.

The evidence presented herein, although not closely paralleling that reported by E. F. Hopkins and K. W. Loucks in the June, 1947, issue of Citrus Industry, tends to substantiate their findings. These two investigations were conducted almost simultaneously but independently and with fruit from different sources and under different conditions.

Conspicuous absence of green mold rot in the Valencias was not unexpected, since the prevalence of this rot regularly diminishes in the spring and summer. There appears no basis for assuming that the Valencia orange is less susceptible to green mold than the winter-ripening varieties which fall a ready prey to it. The decline in the incidence of green mold in the spring seems to be associated with warmer weather and perhaps with less favorable humidity conditions.

A ten percent concentration of 2-AMP was effective in checking green mold in inoculated oranges, but neither 5 percent 2-AMP nor 1½ percent sodium ortho-phenyl-phenate checked green mold rot in inoculated fruit satisfactorily under the conditions of the test; yet it is well known that the latter gives excellent control of the rot under commercial conditions, which are far less harsh than those set up for the tests reported herein.

Applying 2-AMP to wrapping tissues seems to be a promising method of application, especially since it does not bring about an attachment of the fungicide in a solid state to the fruit. Although 2-AMP has an odor, its presence on fruit could not be detected by smelling, nor did it affect the flavor or appearance of the juice of treated fruit.

Summary

A 5 percent solution of 2-aminopyridine (2-AMP) in water or in wax emulsion, applied to oranges after a 50 to 60-hour exposure to ethylene gas, gave very good to excellent control of decay in Florida oranges.

Plain wrapping tissue impregnated with 2-animo-pyridine was effective in checking decay in seedling and Valencia oranges.

Because of the relative absence of Penicillium rot during the period when the principal tests were made, the evidence of effectiveness against that fungus is not so striking as against the stem-end rot fungi.

Limited evidence based on inoculations indicates that weak concentrations of 2-AMP may not be quite so effective as sodium ortho-phenylphenate against green mold for a short period. 2-AMP did not affect the flavor or appearance of the juice of treated oranges.

The feasibility of commercial use of 2-AMP on citrus fruits, from the standpoint of possible toxic effects on consumers, has not yet been determined.

Recommendations Of Citrus Fruit Advisory Committee

The Citrus Fruit Advisory Committee recommends that a balanced program of research be undertaken that will have due regard for both the immediate and long-time needs of the citrus fruit industry as well as the specific requirements of the various producing areas. This broad program of research, the committee believes, is adequately outlined in its June 1947 report, "Citrus Fruits —Outline for Research."

For the fiscal year 1948-49 the committee requests that first emphasis be placed on research that will help with the profitable marketing and utilization of the anticipated large future crops of citrus fruit. Citrus fruit production now is nearly twice as large as just prior to the war, most citrus trees are still young and increasing their bearing surface, and thousands of acres of new citrus trees have yet to come into bearing.

Marketing

Under Title II of the Research and Marketing Act of 1946 it is requested that special attention be given to the development of new and improved merchandising practices.

Utilization

Under Title I of the Research and Marketing Act of 1946 it is requested that a high priority be given to the development of new and improved uses for citrus fruit products.

1. Present research in this field should be expanded as fast as manpower and facilities are available. The funds allotted in 1947-48 were considered to be very small in relation to the importance of the work.
2. Improved methods of preventing decay of citrus fruits as a means of cutting costs and increasing consumer acceptance should be emphasized.
3. Because of the trend toward prepackaging fruits and vegetables, the work done by the Department to determine the best methods of handling citrus fruit in consumer-sized bags should be carried forward.
4. Research also should be done to determine the best methods of storing citrus fruits in order to lengthen the marketing season.
5. Continued efforts should be made to increase consumer accepta-

(Continued on page 22)

The LYONIZER

Department

COMPILED BY THE LYONS FERTILIZER CO.

Reports Of Our Field Men . . .

HILLSBOROUGH AND PINELLAS COUNTIES
C. S. (Charlie) Little

We are having an excellent showing of new bloom in this territory and while at the present writing there is very little open bloom, we are expecting it to burst forth at an early date, and unless we have weather hazards it appears that we will have plenty of fruit for the coming season. Many of our growers are going forward with their regular topdresser application, but we also have some growers that applied a normal application in the fall that are passing up their spring fertilizer and are planning to come in with an early summer application. Rust mite are very active and growers are controlling these pests with their regular dormant sprays. There will not be quite so much spraying done this spring as has been during the past few years, but most growers are planning to do sufficient spraying to keep melanose under control and will follow through with a good oil spray.

SOUTHWEST FLORIDA
Eaves Allison

This section is normally heavy to grapefruit and with prices as they have been very few growers have made any money, but with the prospect of Valencias bringing fairly good money some optimism is beginning to creep in among the growers. In spite of the many set-backs that we have had in this territory most of our growers are planning to follow both a fertilizer and spray program that will result in maximum production. Naturally there is some evidence of too much economy, but this is at a minimum. Glad growers have had their troubles this season, but they are now marketing some very nice flowers. The vegetable crops are looking good and baring unforseen weather hazards we should have a very successful spring season. We think the vegetable growers throughout this territory have done an excellent job all during the fall and spring for in spite of rains, cold weather and other hazardous conditions they have come through with some very nice crops and furnish fresh vegetables for the table when practically all of the country has been covered with snow and ice.

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

Fruit has been moving from this section at a very rapid rate during the past few weeks and at the persent writing it is very evident that most of the early and mid-season oranges have been shipped to market. Valencia oranges are now moving at a very rapid rate and if this movement continues through the next three months we will have very little fruit on the trees by the first of June. Our trees are blooming in very good condition and if weather conditions continue favorable for the next month or two we should get a fine crop of fruit. We have just about completed our spring application of fertilizer and have our dormant spray program under way. Most growers are planning to follow through with a complete fertilizer and spray program that will result in the best quality fruit for the coming season.

SOUTH POLK, HIGHLANDS AND HARDEE COUNTIES
R. L. (Bob) Padgett

Bloom is bursting out all over this territory with seedling trees leading the way, and all varieties of oranges farther advanced than grapefruit. At the present time all indications are that we will have one of the earliest blooms that we have had in several years and this is very pleasing to most of us for it will mean better quality fruit to be placed on the market next fall. With the exception of a few scattered crops the midseason fruit has been moved to market. There has been plenty of activity on the part of fruit buyers for Valencia oranges and consequently growers are feeling very optimistic over Valencia prices. Ther eis plenty of grapefruit left in all parts of this territory with very little interest being shown for them by either the packer or canner. With the coming of spring weather, there has been plenty of evidence of the arrival of heavy infestations of rust mite, and many growers are now spraying or dusting to get this pest under control.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

We have had excellent weather for the past month and citrus groves are looking fine. We have an excellent bloom in prospect and with continued good weather this bloom will be open in a very short time. Vegetable crops are coming along in fine shape with about the same acreage planted as last year. Watermelons are up in most places with fairly good stands. The melon acreage apparently will not be as heavy as last year. Damage to fruit from the cold is still showing up in places, but most of the severely damaged fruit has been moved and everyone is optimistic about what they can get out of the Valencia crop still on the trees. Practically all of the mid-season fruit has been moved. We have had a fairly good application of topdresser applied and practically all growers that had some damage from cold weather have come in with an application of fertilizer.

POLK COUNTY
J. M. (Jim) Sample

We have been in quite a quandary in this territory as to the best procedure to follow as far as fertilizer and spray materials are concerned. However, it is an established fact that it is impossible to produce full crops of quality fruit without ample amounts of fertilizer, so we are going forward with our spring application in which we are adding ample amounts of secondary plant foods. Our spray program will also be carried through in about the usual manner. The recent price increase in Valencia oranges has been very encouraging to most growers, and if prices now in effect are maintained or get better then most growers with a balanced variety of fruit will realize a profit for the season's operations.

CITRUS GROWERS IN SPOTLIGHT

Two Florida citrus growers have been very much in the spotlight during the past month. J. A. Griffin, president of the Exchange National Bank of Tampa, the Exchange National Bank of Winter Haven, citrus grove owner and president of the Elfers Citrus Sub-Exchange, and for many years active in the promotion of the citrus industry of Florida, was recently named the No. 1 citizen of Tampa for the year 1947.

Dan McCarty, citrus grove owner and businessman of Fort Pierce and a former prominent member of the Florida legslature, is an active aspirant for the governorship of the state in the May democratic primaries.

EFFECTS OF LENGTH OF GROWING SEASON AND OIL SPRAY TIMING ON SCALE CONTROL

(Continued from page 9)

ing being July 1-15. It was suggested for large acreages that varieties be sprayed in the following order: early oranges; early grapefruit and mid-season oranges; Valencias; and lastly, unarsenated grapefruit. Where scale infestations are heavy in individual groves, it was suggested that oil sprays be delayed until after July 1.

Literature Cited

Griffiths, J. T. (1947) The role of biological balance in citrus insect control. Cit. Ind. 28 (6): 5, 20-21.

Thompson, W. L. (1942) Some problems of control of scale insects on citrus. Proc. Fla. Hort. Soc., pp. 51-59.

Thompson, W. L. (1947) Factors related to the timing of oil sprays for scale control. Cit. Ind. 28 (8): 5-7.

Thompson, W. L. and J. W. Sites (1945) Relationship of solids and ratio to the timing of oil sprays on citrus. Proc. Fla. Hort. Soc., pp. 116-123.

Thorn, F. T. (1946) Temperature relations to red scale increase. Calif. Citro. 31: 190.

RECOMMENDATIONS OF CITRUS FRUIT ADVISORY COMMITTEE

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bility of citrus fruits through improvements in methods of preparation and by making further determinatinos as to their nutritive values.

Production

Although research on problems of marketing and utilization is to be emphasized in 1948-49, there are three production problems confronting the citrus industry that are potentially so serious as to threaten the continued efficient production of quality citrus fruit in certain areas. The committee recommends that work on each of these problems be given adequate support:

1. Hawaii became infested during the war with a number of fruitflies that would be extremely dangerous to the citrus fruit industry, should they reach the mainland. In Mexico an insect pest called the "citrus blackfly" is now within a couple of hundred miles of the United States border and spreading rapidly. Research work should be undertaken to prevent both of these insects from spreading into the United States. Work also should be done on the eradication and control of the Mexican fruitfly that is already in Texas.

2. Within the past 15 years a virus disease known in South America as tristeza has destroyed much of the citrus fruit on sour orange rootstocks. A similar disease known as "quick decline" in California also is attacking trees on sour orange rootstocks. The threat of these diseases probably means that sour orange rootstocks will be of little use in the future. Approximately one-half of the present citrus acreage of the United States is on this rootstock. As a counter measure to this threat, it is recommended that all practical tests be made of citrus rootstocks and possible rootstock material to determine their relative resistance to tristeza and "quick decline" virus diseases.

3. Citrus nematodes are found in all of the citrus-producing areas. These nematodes, as well as the string nematodes and others, attack and destroy citrus tree roots. So far no effective control has been developed. Special investigations are needed.

Classified Ads